ordination between the work of technical institutes and the needs of employers with a view to active cooperation in the interests of the students and employers and for the general welfare of the country.

To effect this desirable end, great importance is wisely attached to affording to students ample facilities for practical work, not only in school laboratories and school shops, but under strictly commercial conditions in engineering and other industrial firms. Among the causes of the partial failure of Indian students to obtain suitable employment after leaving the technical institute some of the employers who were consulted state that "in most cases students from technical institutions will not work with their hands, will not observe factory hours, ask too high wages for learning their practical work, and generally think they know everything."

It is a fact that in their desire to obtain employment, whether as engineers or civil servants, Indian students undoubtedly attach too great a value to their school teaching, and the Commissioners recommend that school instructors and school managers should make it clear to their students that they are totally unfit for any position of authority immediately on leaving the institute, and must gain, under appropriate conditions of discipline, practical acquaintance with the details of the work in which they hope to be occupied. "Otherwise," they state, "there will always be a large number of men who fail to go further than the end of their college course." This is sound advice, which is not altogether inapplicable to British students. It is satisfactory to gather from the report that the writers are of opinion that Indians "if possessing the necessary character, theoretical knowledge, and practical experience, have more than equal chance of employment in India with Europeans." This statement will be read with equal gratification by those who are responsible in this country for the government of India as by the natives concerned.

Among the valuable recommendations set forth in the closing pages of this report, the importance of practical work is repeatedly emphasised. "The education given in the institute," we are told, "should be essentially practical, be capable of being applied commercially, and not of such high scientific character as is often considered necessary in the West." It is also pointed out that the "best method of training men in mechanical and electrical engineering to meet the existing demand is by a course at a well-equipped institute, followed by an apprenticeship in works."

India is waking up to the necessity of developing new and important industries. For the supply of the machinery needed to equip the increasing number of cotton mills now being erected in India, there will be a growing demand, and endeavours are being made to meet this demand by Indian enterprise and skill. The number of bleaching and dyeing works must be gradually increased with the development of the textile industries; and if only qualified students can be found who have received an adequate training in the technical institutes, new fields of employment will be opened up for native workers.

The report shows how the school may help the factory, and how the factory may offer a continually increasing number of remunerative posts to the trained students of the technical school. In addition to the general recommendations, the report contains useful suggestions for adjusting facilities for technical instruction to meet the demands of employers in the various provinces of India.

RESEARCHES IN RADIO-ACTIVITY.

SEVERAL communications from the Radium Institute at Vienna are before us, and a few of the most noteworthy are here mentioned.

In one of the recent communications from the institute Dr. O. Hönigsmid gives the result of a fresh atomic weight determination from the bromide, which confirms the value, 225·95, previously obtained from the chloride. Two determinations by conversion of the chloride into the bromide and *vice versâ*, the method adopted by Whytlaw-Gray and Sir W. Ramsay, also gave practically identical results. In conjunction with E. Haschek, a spectrographic examination of the preparations for barium was made. The barium line 4554·24 was not seen, and it was calculated from the effect of the addition of known small amounts of barium that the standard preparations could not have contained more than 0·004 per cent. of barium. This settles the question of the purity of the international radium standard, and of the true atomic weight of radium. It is characteristic of the time and of the accurate researches radio-activity has called forth, that the atomic weight of radium should now be one of the best-known constants, and far more certain than that of uranium and thorium.

In another communication, Dr. F. Paneth finds that polonium resembles a colloid in that it does not pass appreciably through animal membranes or parchment paper. Radio-lead may readily be separated from polonium by dialysis, the crystalloid salts of lead readily passing through the membrane and carrying the radio-lead with them in unaltered proportion.

Some further results of H. Molisch bring out the harmful effects of the radium emanation on growing plants when it is present above a certain degree of concentration. In lesser amounts a slightly favourable action on the growth is sometimes observed. The injury is a permanent one, the organs of the plant being affected and the leaves falling off. It appears to work like a poison chemically upon the cells, and considering the minute absolute amount of the emanation, there can be very few poisons which would produce in such small quantity so far-reaching destructive effects.

A. Brommer discusses the influence of the partial solar eclipse of April 17, 1912, on atmospheric electrification. During the first phase of the eclipse a well-marked diminution occurred in the number both of positive and negative ions in the atmosphere, the latter decreasing more rapidly than the former, so that an initial excess of positive ions was converted into a deficit. As the sun's disc again became uncovered, the number of ions increased and regained nearly their initial values, establishing a direct influence of sunlight on the ionisation of the atmosphere.

Exner and Haschek describe an unsuccessful attempt to find spectroscopic evidence of the existence of ionium in the thorium-ionium preparations separated from ten tons of Joachimsthal pitchblende by A. v. Welsbach. A similar attempt, with the same negative result, by A. S. Russell and R. Rossi, with the Royal Society's ionium preparation, is described in a recent number of the Proceedings of the Royal Society (p. 478). In view of the estimated period of ionium being from forty to one hundred times as long as that of radium, both these preparations should have contained a considerable proportion of ionium, and the failure to detect in their spectra a single line other than those due to known substances raises very important and fundamental questions.

A. Kailan, in three papers, deals with the influence

of ultra-violet light and of the penetrating rays of radium on various organic and inorganic compounds, and Meyer and Przibram discuss, among other phenomena, the effect of exposure to radium rays in increasing the "Hallwachs effect" in minerals.

Meyer and Paneth have undertaken a re-investigation of the proportion of α rays in a uranium mineral due to the uranium and radium respectively, which they find to be 100 : 57·3, instead of 100 : 45, as found initially by Boltwood. The new ratio agrees perfectly with the present view that uranium consists of two elements, uranium I. and II., each emitting one α ray per atom disintegrating, of ranges respectively 2·5 and 2·9 cm. of air at 15°, with which the older ratio was seriously in disagreement.

Lastly, Hess deals with the heat generated by a pure radium salt at the moment of its preparation, when it is free from the products of disintegration, and finds it to be 25·2 calories per hour per gram of radium (element). In the course of a month, in which the first four products accumulate to the equilibrium quantity, the heat generated increases by 107·1 cal. per hour, the total (for α and β rays, and 18 per cent. of the γ rays) agreeing perfectly with his previous measurements in collaboration with Prof. Meyer on a different preparation. As an example of the perfection to which our knowledge of the processes of atomic disintegration has been brought, and to which it would perhaps be difficult to find a parallel elsewhere in the molecular sciences, it may be mentioned that the figure 25·2 calories per hour per gram of radium agrees, within 1 per cent., with the value deduced from Rutherford's direct measurements of the number, mass, and velocity of the α particles expelled by radium, taking into account the kinetic energy of recoil. An analogy to this would be a determination of the "heat-drop" of steam by counting the number, measuring the individual mass, and determining directly the velocity of the molecules leaving a turbine-jet. F. S.

SCIENTIFIC WORK OF THE CENTRAL CHEMICAL LABORATORY OF THE ITALIAN CUSTOMS.

THE report of the year's work of the Central Chemical Laboratory of the Italian Customs at Rome (*Annali del Laboratorio Chimico Centrale delle Gabelle*, vol. vi., 1912, pp. xxxvii+707), under the direction of Prof. V. Villavecchia, which has recently been issued, contains an introductory article by the director on the history of its twenty-five years' activity since its inauguration in 1885. In this period 225,679 analyses have been made, and 1524 special reports prepared for various Government departments, whilst 127 original papers have been published in the *Annali* issued from the laboratory. Recently a museum of commercial products and raw materials has been established in connection with the Central Laboratory, care being taken to ensure the genuine character of all the specimens, so that they can be used as standards of reference by the Government chemists; an account is given in the report of the 32,382 samples collected for this museum, and a description of the building.

In the present report some of the most important original contributions are as follows. I. Barboni has investigated comparatively the different methods which have been used for the analysis of commercial calcium citrate, and reports on their suitability. A. Capelli, in examining the alkaloids contained in maté, has been able to separate only caffeine, although the statement has been recently made that caffeine is present only in traces, the principal alkaloid being matteine. There is a series of papers by R. Belasio on the electrolytic estimation of zinc, the separation by electrolysis of iron and manganese, the analysis of white metals and tinfoil, the detection of antimony and of tin in metallic alloys, and a description of the electrolytic methods of analysis in use in the laboratory of the *Gabelle*. Among papers dealing with organic analysis the following may be cited:—G. Testoni, the estimation of sucrose in the presence of other sugars; E. Castaldi, the Halphen test for cotton-seed oil; L. Settimj, a characteristic colour reaction for soja-bean oil; S. Camilla and C. Pertusi, the detection and estimation of the xanthine bases in cocoa, tea, and coffee; V. Villavecchia and A. Capelli, the quantitative estimation of cotton, wool, and silk in mixed fabrics.

Independently of its work of routine analyses for the control of commercial and dutiable articles, the laboratory is carrying out valuable work in investigating the many different and often conflicting methods of analysis in current use, and, when necessary, devising new processes to meet freshly arising needs.

THE HYDROMETER AS AN INSTRUMENT OF PRECISION.[1]

MR. J. Y. BUCHANAN publishes in the Transactions of the Royal Society of Edinburgh (vol. xlix., part i., 1912) the results of extended researches on the specific gravity and the displacement of some saline solutions. The memoir, which occupies 225 quarto pages, deals with the densities and variations in densities of certain groups of saline solutions; but although the results obtained are themselves of interest and value, the importance of the work centres rather in the detailed study of the use of the hydrometer as an instrument for work requiring a high degree of accuracy. This importance, of course, arises mainly from the fact that ever since the days of the *Challenger* expedition, Mr. Buchanan has been the principal champion of the hydrometer method for determining the specific gravities of samples of sea-water for purposes of oceanography, and that the method has now for many years been practically disused by most oceanographers.

Two forms of hydrometer are described. In the "closed" type—that ordinarily used for, *e.g.*, sea-waters—the weight of the instrument is varied by adding to or subtracting from a number of weights placed on the top of the glass stem of the hydrometer. The additional weights are obviously limited by questions of stability, for if too much weight is accumulated at the top of the stem the whole instrument will tend to capsize. Solutions of high density are therefore treated with an instrument of the "open" type, in which the stem is left open at the top instead of being hermetically sealed, and the paper scale is replaced by one etched on the stem itself. The internal ballast can then be altered by varying the amount of mercury or the number of lead pellets, as the case may be, and the final adjustment by weights at the top of the stem made without risk of the instrument swinging out of the vertical.

Every worker with the closed type of instrument (that used on board the *Challenger*) knows that the real difficulty is not to get consistent results, but to get accurate results, or results which will either agree with those obtained by other methods or differ from them in some way which can be accounted for. Much labour has been expended by many investigators in efforts

[1] "Experimental Researches on the Specific Gravity and the Displacement of Some Saline Solutions." By J. Y. Buchanan, F.R.S. (Trans. R.S.E., vol. xlix., part i., 1912.) Pp. 227. (Edinburgh: Neill and Co., Ltd., 1912. Price 7*s.* 6*d.* net.